भारतीय मानक
Indian Standard

IS 13630 (Part 10) : 2019

सिरैमिक टाइलें — परिक्षण पद्धतियां, नमूने लेने तथा स्वीकार्यता का आधार

भाग 10 फ्रोस्ट प्रतिरोधिता ज्ञात करना

(दूसरा पुनरीक्षण)

Ceramic Tiles — Methods of Test, Sampling and Basis for Acceptance

Part 10 Determination of Frost Resistance

(Second Revision)

ICS 91.100.23

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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Flooring, Wall Finishing and Roofing Sectional Committee, CED 05

FOREWORD

This Indian Standard (Part 10) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

This standard (Part 10) was first published in 1993 and subsequently revised in 2006. This second revision incorporates the experience gained with the use of this standard and brings the standard in line with the latest developments in this field.

The following are the significant modifications incorporated in this revision:

a) The temperature cycle has been modified; and
b) Only one method of impregnation with water has been specified.

This Indian Standard is published in several parts. The other parts in this series are:

Part 1	Determination of dimensions and surface quality
Part 2	Determination of water absorption and bulk density
Part 3	Determination of moisture expansion using boiling water
Part 4	Determination of linear thermal expansion
Part 5	Determination of resistance to thermal shock
Part 6	Determination of modulus of rupture and breaking strength
Part 7	Determination of stain and chemical resistance of unglazed tiles
Part 8	Determination of stain and chemical resistance of glazed tiles
Part 9	Determination of crazing resistance of glazed tiles
Part 11	Determination of resistance to surface abrasion of glazed tiles
Part 12	Determination of resistance to deep abrasion of unglazed tiles
Part 13	Determination of scratch hardness of surface according to Mohs' scale
Part 14	Determination of impact resistance by measurement of coefficient of restitution
Part 15	Sampling and basis for acceptance
Part 16	Determinations of lead and cadmium given off by glazed tiles

In the formulation of this standard considerable assistance has been derived from the ISO 10545-12 : 1995 'Ceramic tiles — Part 12: Determination of frost resistance'.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

CERAMIC TILES — METHODS OF TEST, SAMPLING AND BASIS FOR ACCEPTANCE

PART 10 DETERMINATION OF FROST RESISTANCE

(Second Revision)

1 SCOPE

This standard (Part 10) covers a method of test for evaluating the frost resistance of all ceramic tiles intended for use in conditions of frost in the presence of water.

2 PRINCIPLE

After impregnation with water tiles are cycled between +5 °C and -5 °C, all sides of tiles are exposed to freezing during 100 freeze thaw cycles.

3 APPARATUS

3.1 Drying Oven, capable of operation at 110 ± 5 °C.

3.2 Balance, weighing to 0.1 percent of the mass of a test specimen.

3.3 Container, for impregnation by capillarity or immersion with stable horizontal supports.

3.4 Apparatus for impregnation with water after evacuation by means of a vacuum pump capable of lowering than air pressure by 40 ± 2.6 kPa in a tank containing tiles.

3.5 A freezer capable of freezing at least ten tiles having a minimum total area of 0.25 m^2 supported in such a manner that the tiles shall be separated.

3.6 Chamois Leather

3.7 Demineralized water, if water hardness less than 400mg/l calcium carbonate + magnesium carbonate ($CaCO_3$ + $MgCO_3$) (or equivalent hard water salts) at 15° to 25 °C is not available.

4 TEST SPECIMENS

4.1 Sample

A minimum area of 0.25 m^2 and not less than 10 whole tiles shall be used. The tiles shall be free from dust.

NOTE — If tiles with defects such as cracks, crazing, holes, nipped edges and nipped corners have to be tested then the defects shall be marked with a permanent stain prior to the test and these defects shall be examined after testing.

4.2 Preparation

Dry the tiles in the oven at 110 ± 5 °C until constant mass is reached, that is, when the difference between two successive weighing at intervals of 24 h is less than 0.1 percent. Record the dry mass of each tile (m_1).

5 IMPREGNATION WITH WATER

5.1 Place the tiles vertically in the dry vacuum tank with no contact between them and no contact with the vacuum tank. Connect to the vacuum pump and evacuate to a pressure of 40 + 2.6 kPa below atmospheric pressure and maintain the pressure for 15 min. Bring the water into the tank containing the tiles whilst maintaining this pressure and cover the tiles by at least 50 mm head of water. Maintain the evacuation at the same pressure for a further 15 min and then restore atmospheric pressure.

5.2 Prepare chamois leather by wetting and wringing out by hand. Place it on a flat surface and lightly dry each side of each tile in turn. Dab any relief surfaces with the chamois leather.

5.3 Record the wet mass of each tile (m_2).

5.4 Calculation of Water Content

The water content expressed as a percentage (by mass) is determined from:

$$Wc_1 = \frac{(m_2 - m_1)}{m_1} \times 100$$

where

Wc_1 = water content by mass (percent),
m_1 = dry mass of each tile, and
m_2 = wet mass of each tile.

6 PROCEDURE

6.1 Select one of the thickest tiles that are under test. It shall be one considered to have repressive properties of that test sample. Drill a 3 mm diameter hole from the centre of one edge to a maximum distance of 40 mm from the edge of the tile. Insert thermocouple or other suitable measuring device and seal the hole with a tiny piece of thermally insulating material (for example extended polystyrene). If it is not possible to drill a hole in this way, place a thermocouple on the center of each face of a tile and adhere a second tile over this.

6.2 Place all the tiles under test in the freezer in such way that there is air space between each one and air flow over all surfaces. Place the tile with thermocouple in the middle of the test samples. The temperature of the thermocouple defines the temperature of the entire tile under test. Only in the case of repeated tests with similar test specimens can this be omitted and then occasional check shall be made with a thermocouple in a tile. When there is no temperature reference tile the air temperature shall be measured. All temperature measurements shall be accurate to ± 0.5 °C.

6.3 Lower the tile temperature to -5 °C at a rate not exceeding 20°C/h. Maintain the tile temperature below -5 °C for 15 min. Immerse the tile in or spray it with water until a tile temperature above + 5 °C is reached. Maintain the tile temperature above + 5 °C for 15 min. Repeat the cycle a minimum of 100 times. Interruption of the cycles shall be permitted only if the tiles are kept submerged in water above + 5 °C.

6.4 Weigh the tiles after the test (m_3) and then dry them to constant mass (m_4). The final water absorption, Wc_2, expressed as a percentage by mass, is calculated using the equation:

$$Wc_2 = \frac{(m_3 - m_4)}{m_4} \times 100$$

where

Wc_2 = final water content by mass (percent),

m_3 = wet mass of each tile after the test, and

m_4 = dry mass of each tile after the test.

6.5 After 100 cycles, examine the glazed or proper surfaces and the edges of the tiles by the naked eye, with the aid of spectacle if usually worn, at a distance of 25 cm to 50 cm with an illumincation of approximately 300 lx. They may be examined at the intermediate stages to expedite the reporting if there is a reason to believe that they might sustain damage relatively early in the test. Record all damage that is observed on the glazed or proper surfaces and the edges of the tiles.

7 TEST REPORT

The test report shall contain the following:

a) Identification of the tile;
b) Number of tiles in the test sample;
c) Method used to impregnate the tiles with water;
d) Water content obtained before the freeze-thaw test;
e) Water content obtained after the freeze-thaw test;
f) Description of defects before the test and all damage on the glazed or proper surfaces and the edges of the tiles after the freeze-thaw test; and
g) Number of damaged tiles after 100 cycles.

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Flooring, Wall Finishing and Roofing Sectional Committee, CED 05

Organization	*Representative(s)*
In Personal Capacity (*L/109, Sarita Vihar, New Delhi*)	Shri Ashok Khurana (***Chairman***)
Ardex Endura India Pvt Ltd, Bengaluru	Shri K. P. Paulson Shri Gopinath Krishnan (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	Shri S. K. Gupta Shri Pankaj Gupta (*Alternate*)
Carborundum Universal Limited, Chennai	Shri R. Rajagopalan Dr N. Ramasubramanian (*Alternate*)
Central Public Works Department, New Delhi	Shri Rajesh Kumar Kaushal Shri Arun Kumar Tyagi (*Alternate*)
CSIR − Central Building Research Institute, Roorkee	Shri S. K. Singh Shri Achal Kumar Mittal (*Alternate*)
CSIR − Central Glass & Ceramic Research Institute, Kolkata	Dr Satyendra Nath Misra
CSIR − Central Road Research Institute, New Delhi	Dr Rakesh Kumar
Choksi Laboratories Limited, Indore	Shri R. D. Mathur Shri Ramesh Basappa (*Alternate*)
Construction Chemicals Manufacturers Association, Navi Mumbai	Shri Upen Patel Shri Samir Surlaker (*Alternate*)
Construction Industry Development Council, New Delhi	Shri P. R. Swarup Shri Ravi Jain (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Dwk) Superintending Engineer (P) (*Alternate*)
Directorate General of Border Roads, New Delhi	Col Indra Kumar Jaggi
Engineers India Limited, New Delhi	Shri J. K. Bhagchandani Shri Akhilesh Maurya (*Alternate*)
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H. R. Johnson (India) Limited, Dewas	Shri Arun Rao
Indian Council of Ceramic Tiles & Sanitaryware, New Delhi	Shri Arun Rao Shri P. K. Sharma (*Alternate*)
Institution of Engineers (India), New Delhi	Shri K. K. Kapila
Lloyd Insulation (India) Pvt Limited, New Delhi	Shri Mohit Khanna Shri K. K. Mitra (*Alternate*)
Mapie Construction Products India Pvt Ltd, Bengaluru	Dr G. S. Ravi Shankar Shri Abhijit Dutta (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, New Delhi	Shrimati Mala Mohan Shrimati Namrata Kohli (*Alternate*)
Modern Tiles & Marble, New Delhi	Shri Subhash Kapoor Shri Kameswar Rau (*Alternate*)
Morbi Dhuva Glaze Tiles Association, Morbi	Shri Nilesh Jetparia Shri Jeram Madhav Kavar (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Representative

Organization	*Representative(s)*
MYK Laticrete India, Hyderabad	Dr P. Arjunan Shri N. Radhakanth (*Alternate*)
National Council for Cement and Building Materials, Ballabgarh	Dr S. K. Breja
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New Delhi Municipal Corporation, New Delhi	Representative
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Shriram Institute of Industrial Research, New Delhi	Dr P. K. Kaicher Dr Laxmi Rawat (*Alternate*)
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and

Shri Milind Gupta
Scientist 'C' (Civil Engineering), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi
KOLKATA 700054 — 2337 8499, 2337 8561, 2337 8626, 2337 9120

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg
CHANDIGARH 160019 — 265 0206, 265 0290

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113 — 2254 1216, 2254 1442, 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
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